

WHAT IS CLAIMED IS:

1. An aqueous sizing composition comprising:
 - (a) an emulsion comprising alkenylsuccinic anhydride component containing alkenylsuccinic anhydride particles suspended in an aqueous polymer solution, and
 - (b) a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water-soluble polymer, water, and mixtures thereof,wherein the alkenylsuccinic anhydride component is sufficiently dilute to enable the sizing composition to impart useful sizing properties to a fibrous substrate when the sizing composition contacts the fibrous substrate.
2. The process of Claim 1, wherein the polymer is selected from the group consisting of vinyl addition polymers, condensation polymers, and combinations thereof.
3. The process of claim 1, wherein the water-soluble polymer is present in the emulsion at an alkenylsuccinic anhydride:water-soluble polymer weight ratio range of 1:0.05 to about 1:1.
4. The process of claim 1 wherein the alkenyl succinic anhydride component in the aqueous sizing composition is present at an amount ranging from about 0.001 to 5 wt %.
5. The sizing composition of Claim 1, wherein the composition contains surfactant component selected from the group consisting of sulfosuccinates, alkyl and aryl amides and primary, secondary and tertiary amines and their corresponding quaternary salts fatty acids, ethoxylated fatty acids, fatty alcohols, ethoxylated fatty alcohols, fatty esters, ethoxylated fatty esters, ethoxylated triglycerides, certain ethoxylated lanolin, sulfonated amines, sulfonated amides, ethoxylated polymers, propoxylated polymers, ethoxylated/ propoxylated copolymers, polyethylene glycols, phosphate esters, phosphonated fatty acid

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ethoxylates, phosphonated fatty alcohol ethoxylates, alkyl sulfonates, aryl sulfonates, alkyl sulfates, aryl sulfates, and combinations thereof.

6. The sizing composition of Claim 1, wherein the surfactant component is present at a level ranging from about 0.1 weight % up to about 20 weight %, based on alkenylsuccinic anhydride.

7. The sizing composition of Claim 1, wherein the alkenyl succinic anhydride particles have a median particle size ranging from about 0.5 to about 20 microns.

8. The sizing composition of Claim 1, wherein the alkenylsuccinic anhydride component further comprises hydrolyzed alkenylsuccinic anhydride in an amount ranging from about 1 to about 99%, based on the total weight of the alkenylsuccinic anhydride.

9. The sizing composition of Claim 1, wherein the sizing composition is of sufficient dilution so that when the sizing composition treats a fibrous substrate, the treated fibrous substrate has a Cobb sizing of less than about 150 gsm for 30 minutes or about 100 gsm for two minutes.

10. The sizing composition of Claim 1, wherein the sizing composition is of sufficient dilution so that if the sizing composition treats a fibrous substrate, the treated fibrous substrate retards ink penetration, giving an HST value of at least ten seconds.

11. The sizing composition of Claim 1, wherein the sizing composition is of sufficient dilution to minimize the sizing composition from coalescing at a temperature ranging from about 40 to about 185 °F.

12. The sizing composition of Claim 1, wherein the alkenyl succinic anhydride particles have a monomodal particle distribution.

13. The sizing composition of Claim 1, wherein the alkenyl succinic anhydride particles have a bimodal or a multimodal particle distribution.

14. A fibrous substrate treated with the sizing composition of Claim 1.

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15. The fibrous substrate of Claim 14, wherein the substrate is paperboard.

16. The fibrous substrate of Claim 15, wherein the paperboard exhibits a Cobb sizing value, based on one minute, ranging from about 50
5 to about 120 grams per square meter.

17. The fibrous substrate of Claim 14, wherein the substrate is fine paper.

18. The fibrous substrate of Claim 17, wherein the fine paper exhibits a Cobb sizing value, based on 1 minute, ranging from about 18 to
10 about 40 gsm.

19. The fibrous substrate of Claim 14, wherein the substrate is selected from the group consisting of newsprint, other wood-containing papergrades, and combinations thereof.

20. The fibrous substrate of Claim 18, wherein the substrate
15 is newsprint substrate that exhibits a sizing property ranging from about 10 to about 100 seconds, as measured by a water drop test, based on 5 μ L water drop size.

21. A process for making a sizing composition comprising the steps of:

20 (a) emulsifying an alkenylsuccinic anhydride component, optionally containing a surfactant, with an aqueous polymer solution, and thereby forming an emulsion, and

(b) combining the emulsion with a second component selected from the group consisting of cationic starches, non-ionic starches, anionic
25 starches, water-soluble polymer, water and mixtures thereof, and thereby forming the sizing composition.

22. The process of Claim 21, wherein the polymer is selected from the group consisting of vinyl addition polymers, condensation polymers, and combinations thereof.

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23. The process of Claim 21, wherein the surfactant component is present at a level ranging from about 0.1 weight % up to about 20 weight %, based on the alkenylsuccinic anhydride.

24. The process of Claim 21, wherein the polymer
5 component has a temperature ranging from about about 4 C to about 66°C.

25. The process of Claim 21, wherein the alkenylsuccinic anhydride component has a temperature ranging from about about 4 C to about 66°C.

10 26. The process of Claim 21, wherein the pressure at which the emulsion is made ranges from about 1 psig to about 150 psig.

27. The process of Claim 21, wherein the temperature at which the emulsion is made ranges from about 40 °F to about 185°F.

28. The process of Claim 21, wherein the emulsion is made with
15 a shearing device having an inlet pressure that is at least about 1 psig.

29. The process of Claim 21, wherein the emulsion is made with a shearing device having an inlet pressure ranging from about 1 psig to about 25 psig.

30. The process of Claim 21, wherein the emulsion is made with
20 a shearing device having an outlet pressure ranging from about 15 psig to about 160 psig.

31. The process of Claim 21, wherein the emulsion is made under shear conditions created by a device selected from the group consisting of centrifugal pumps, static in-line mixers, peristaltic pumps,
25 magnetic stirring bar in a beaker, overhead stirrer, and combinations thereof.

32. A process for sizing a paper product comprising treating a fibrous substrate surface with an aqueous sizing composition comprising:

(a) an emulsion comprising alkenylsuccinic anhydride component
30 containing alkenylsuccinic anhydride particles suspended in an aqueous polymer; and

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(b) a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water-soluble polymer, water and mixtures thereof, such that the alkenylsuccinic anhydride component is sufficiently dilute to enable the sizing composition to impart useful sizing properties to a fibrous substrate when the sizing composition contacts the fibrous substrate.

33. The process of Claim 32, wherein the sized fibrous substrate is paperboard.

34. The process of Claim 32, wherein the paperboard exhibits a Cobb sizing value, based on one minute, ranging from about 50 to about 120 grams per square meter.

35. The process of Claim 32, wherein the sized fibrous substrate is fine paper.

36. The process of Claim 32, wherein the sizing composition is added to a water box.

37. The process of Claim 36, wherein the sized fibrous substrate exhibits a Cobb sizing value, based on 1 minute, ranging from about 18 to about 40 gsm.

38. The process of Claim 32, wherein the sized fibrous substrate is selected from the group consisting of newsprint, other wood-containing papergrades, and combinations thereof.

39. The process of Claim 38, wherein the substrate is newsprint that exhibits a sizing property ranging from about 10 to about 100 seconds, as measured by a water drop test, based on 5 μ L water drop size.

40. The process of Claim 32, wherein about 100% of the alkenylsuccinic anhydride in the sizing composition is retained in the fibrous substrate.

41. The process of Claim 32, wherein the temperature at which the first component is made is less than about 40 °F, the temperature at which the second component ranges from more than about 40 °F to about

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200 °F, and the emulsion is heated when it is combined with the second component.

42. The process of Claim 32, wherein the sizing composition is made by (a) emulsifying an alkenylsuccinic anhydride component containing (i) alkenylsuccinic anhydride and, optionally, a surfactant component, with an (ii) aqueous polymer; and thereby forming an emulsion having an alkenylsuccinic anhydride component containing (i) alkenylsuccinic anhydride particles; suspended in an aqueous polymer; and

(b) combining the emulsion with a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water-soluble polymer, water and mixtures; thereby forming the sizing composition.

43. The process of Claim 42, wherein the emulsion is made under shear conditions created by a device selected from the group consisting of centrifugal pumps, static in-line mixers, peristaltic pumps, magnetic stirring bar in a beaker, overhead stirrer, and combinations thereof.

44. The process of Claim 32, wherein the emulsion is made under high shear conditions.

45. The process of Claim 32, wherein prior to treating the fibrous substrate surface, the process further comprises treating the fibrous sheet with a wet end sizing agent, wherein the wet end sizing agent component is present in an amount that is 50% or less of the total sizing agent used.

46. An aqueous sizing composition comprising:

(a) a heated first component, an emulsion comprising alkenylsuccinic anhydride component containing alkenylsuccinic anhydride particles suspended in an aqueous polymer solution; suspended in water; and

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(b) a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water, water-soluble polymers, and mixtures thereof;

5 wherein the alkenylsuccinic anhydride component and the second component are sufficiently diluted to enable the sizing composition to impart useful sizing properties to a fibrous substrate when the sizing composition contacts the fibrous substrate, and wherein the sizing composition has a temperature that is more than about 4 °C.

47. An aqueous sizing composition comprising:

10 (a) an emulsion comprising alkylene ketene dimer component containing alkylene ketene dimer particles suspended in an aqueous polymer solution, and

(b) a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water-soluble polymer, water, and mixtures thereof,

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wherein the alkylene ketene dimer component is sufficiently dilute to enable the sizing composition to impart useful sizing properties to a fibrous substrate when the sizing composition contacts the fibrous substrate.